APPARATUS FOR SENDING AND/OR RECEIVING DATA IN AN SDH OR, RESPECTIVELY, PDH TRANSMISSION SYSTEM

Background of the Invention

The present invention is directed to an apparatus and a method for sending and/~~or~~ receiving data such as, for example, compressed voice data in an SDH or, ~~respectively,~~ PDH transmission system.

In the transmission of data such as, for example, compressed voice data in SDH or, ~~respectively,~~ PDH transmission systems (SDH: synchronous digital hierarchy, PDH: plesiochronic digital hierarchy), data incoming on a plurality of different voice channels are combined in time-division multiplex and transmitted via a single channel such as, ~~for example,~~ a 64 kbit/s channel. ~~An~~ occupancy of the transmission path ~~that is higher by the~~ compression factor ~~thus derives~~. Up to now, static multiplexing methods were employed for ~~the~~ combining ~~of the~~ channels such as, ~~for example,~~ in mobile radiotelephony. The pre-condition ~~therefor~~ is that all data incoming on the various voice channels are compressed to the same rate and that this rate does not change during operation. The data on the various data channels arrive regularly and are statically multiplexed, i.e. according to a specific, fixed strategy.

This has the disadvantage that a flexible transmission of different data rates is not possible for the individual voice channels. In static multiplexing, further, no reduction of the channel width is possible on the basis of speech pause suppression.

The ATM adaptation layer 2 (AAL 2) was defined in the standard ITU-T I.363.2 for the common transmission of a plurality of voice channels via ATM transmission networks (ATM: asynchronous transfer mode). The AAL2 specification describes a cell-oriented, two-stage method that is explained with reference to Figures 4 and 5. In the first stage, voice data supplied on a plurality of voice channels 1a, 1b, ... 1n are arranged in mini-cells 7 of flexible length in a means 2. Such mini-cells 7a, 7b, .. 7n are shown by way of example in Figure 5. Each mini-cell comprises a mini-cell header 8a, 8b, ... 8n at its beginning. The part of the mini-cells 7a, 7b, ... 7n following the respective mini-cell header contains the respective voice data 9a, 9b, ... 9n of the respective voice channel 1a, 1b, ... 1n.

ART 34 AMDT

The mini-cells 7a, 7b, ... 7n are combined into a single data stream in a means 3, (i.e. arranged following one another), as shown in Figure 5. The means 3 ~~thus~~ implements a static multiplexing of the mini-cells 7a, 7b, ... 7n in order to merge them to form a single data or, ~~respectively,~~ mini-cell stream.

In the second stage of the method described in the AAL2 specification, the data stream is subsequently packed in ATM data packets in a means 4. In other words, data packets that correspond to the asynchronous transfer mode are generated from the data stream in the means 4. An ATM header 10, as well as a start field 11 are thereby attached to each ATM data packer at its start. The start field 11, contains an offset field 12, as well as a sequence number 13 and a parity bit 14. The offset field 12 ~~thereby~~ contains information about the position of the respective mini-cells 7 in the ATM data packet. The ~~following~~ following ATM data packet similarly contains an ATM header 15, a start field 16 and a mini-cell 7n. The space that is not required in this ATM data packet is filled with stuffing data 17.

In a means 5, the ATM data packets are converted into frame structures, (i.e. into transmission frames), that correspond to the SDH or, ~~respectively,~~ PDH transmission system in which the data are to be transmitted. The transmission can be accomplished by ~~thereby ensue~~, for example, ~~via~~ radio or ~~via~~ fixed lines. The transmitted SDH or, ~~respectively,~~ PDH transmission frames are received by a reception means that comprises the corresponding, inverse devices as the transmission means shown in Figure 4. The disadvantage of this method described in the AAL2 specification is that the voice data must first be inserted into ATM data packets before they can be transmitted in the SDH or, ~~respectively,~~ PDH transmission system, ~~as~~ As a result, ~~whereof~~ the available or, ~~respectively, possible~~ potential transmission bandwidth is reduced.

The document by Johnsson, M. et al., "SUPPORT FOR LOW BITRATE APPLICATIONS IN ATM NETWORKS", PROCEEDINGS OF IPIP WORKSHOP ON PERFORMANCE MODELLING AND EVALUATION OF ATM NETWORKS, 3 June 1996, pages 39/1 through 39/14, XP002045906, is concerned with the problem of low bitrate data transmission (~~for example~~, e.g. ~~of~~ voice data) via an ATM network. The data are ~~thereby likewise~~ similarly arranged in mini-cells. The mini-cells are, in turn, multiplexed into an ATM cell flow and sent via the ATM network.

SUMMARY OF THE INVENTION

It is thus the object of the present invention is thus to offer an apparatus for sending data in an SDH or, respectively, PDH transmission system according to the preamble of the attached claim 1, a method for sending data in an SDH or, respectively, PDH transmission system according to the attached claim 6, an apparatus for receiving data in an SDH or, respectively, PDH transmission system according to the preamble of the attached claim 10 and a method for receiving data

according to the attached claim 15 that enable an increased transmission bandwidth in the transmission of data, for example compressed voice data.

This object is achieved by an apparatus and a method for sending data in an SDH or, respectively, PDH transmission system comprising the features of the attached claim 1 or, respectively, the features of the attached claim 6. The object is also achieved by an apparatus and a method for the reception of data in an SDH transmission system comprising the features of the attached claim 10 or, respectively, of the attached claim 15.

The apparatus and the method for sending data in an SDH or~~, respectively,~~ PDH transmission system according to the present invention are particularly characterized in that the single data stream composed of the mini-cells is imaged into the frame structure of the SDH or~~, respectively,~~ PDH transmission system in a direct way instead of~~ or, respectively, as an alternative~~ to the generation of data packets (ATM data packets) corresponding to the asynchronous transfer mode.

Given the apparatus or~~, respectively, given the~~ and method for receiving data in an SDH or~~, respectively,~~ PDH transmission system according to the present invention, correspondingly, a data stream from which the mini-cells are, in turn, restored is generated in a direct way from the incoming transmission frame corresponding to the SDH or~~, respectively,~~ PDH transmission system instead of~~ or, respectively, as an alternative to the generation of~~ generating ATM data packets.

~~The~~ Hence, the present invention ~~thereby~~ allows a significantly better usage of the transmission bandwidth in SDH or~~, respectively,~~ PDH transmission systems, for example in the transmission of compressed voice data. Further, the present invention also allows the employment of different compression rates and compression methods within a multiplex bundle and, in particular, the use of a speech pause suppression wherein the transmission capacities that are not needed during speech pauses are filled up with the voice data of other channels~~, for example~~, for example by statistical multiplexing.

Advantageous developments of the present invention are defined in the respective subclaims.

Given the apparatus and method for sending data according to the present invention, position information with respect to the position of the first mini-cell in the transmission frame are thereby advantageously generated for each transmission frame generated directly from the data stream. These position data are advantageously arranged at the beginning of the respective SDH PDH transmission frame. It is also advantageous when a statistical time-division multiplexing of the data incoming in the plurality of data channels is implemented upon generation of the data stream in the apparatus and method for sending data. The statistical time-division multiplexing makes its possible to multiplex data incoming with different compression rates on the various voice channels and produce a single data stream. When the inventive apparatus for sending data should also be capable of transmitting data corresponding to the AAL2 specification, then a means for generating ATM data packets from the data stream and a means for generating transmission frames corresponding to the SDH or PDH transmission system from the ATM data packets are to be provided. In this case, the inventive apparatus can transmit data corresponding to the AAL2 standard and corresponding to the present invention either in parallel fashion or alternatively. In particular, the present invention also assures the compatibility of the apparatus or method for sending or, respectively, receiving data with the AAL2 specification and/or with higher layers of standards yet to be defined. Hence, the present invention allows utilization of existing AAL2 standards and of AAL2 standards yet to be defined while avoiding the loss of transmission bandwidth connected with the use of ATM cells.

In the apparatus and method for receiving data according to the present invention, the data stream is advantageously generated on the basis of position data with respect to the position of the first mini-cell in the transmission frame that are contained in every SDH or PDH transmission frame. Advantageously, the position data are thereby arranged at the beginning of the respective transmission frame. The distribution of the data contained in mini-cells in the data stream is implemented by demultiplexing the data stream according to the

information contained in the mini-cell header. ~~So that the~~ In order to allow the inventive apparatus ~~for receiving data can also~~ to be employed in a transmission system that is based on the AAL2 specification, a means for recovering data packets corresponding ~~to the~~ to the ATM transmission mode from the SDH ~~or, respectively,~~ PDH transmission frames and a means for generating the data stream from the ATM data packets are also to be advantageously provided. The reception of the data according to the AAL2 specification can thereby ~~ensue~~ be carried out in a fashion parallel or ~~alternatively to~~ alternating with the inventive data reception.

The present invention is also directed to a system for the transmission of data in an SDH ~~or, respectively,~~ PDH transmission system that comprises an apparatus for sending data and an apparatus for receiving data according to the present invention.

~~The present invention is explained in greater detail below on the basis of preferred exemplary embodiments with reference to the attached drawings, which show:~~

Figure 1 illustrates a block diagram of an apparatus for sending data in an SDH ~~or, respectively,~~ PDH transmission system according to the present invention;

Figure 2 is a schematic illustration of the ~~inventively~~ generated mini-cells and transmission frames when sending data;

Figure 3 shows a block diagram of an apparatus for receiving data in an SDH ~~or, respectively,~~ PDH transmission system according to an embodiment of the present invention;

Figure 4 illustrates a block circuit diagram of an apparatus for sending data in an SDH ~~or, respectively,~~ PDH transmission system according to the AAL2 specification; and

Figure 5 is a schematic illustration of mini-cells and ATM cells generated according to the AAL2 specification.

Figure 1 shows a block circuit diagram of an exemplary embodiment of an apparatus for sending data in an SDH or ~~respectively,~~ PDH transmission system according to an embodiment of the present invention. Voice data supplied in a plurality of different voice channels 1a, 1b, ... 1n are arranged in mini-cells 7a, 7b, ... 7n in a means or mini-cell arrangement unit 2. The mini-cells 7a, 7b, ... 7n have flexible lengths dependent on the respective voice dataset, as

schematically shown in Figure 2. The start of each mini-cell 7a, 7b, ... 7n is formed by a mini-cell header 8a, 8b, ... 8n that is followed by the respective voice data 9a, 9b, ... 9n of corresponding length.

The mini-cells 7a, 7b, ... 7n are combined into a single data stream in a statistical multiplexer 3, ~~whereby~~ wherein the mini-cells that are formed are joined to one another dependent on their chronological arrival, as shown in Figure 2.

The transmission means shown in Figure 1 also comprises a transmission branch according to the AAL2 specification, wherein a means 4 generates ATM data packets or, ~~respectively,~~ data packets (i.e., ATM Data Packet Generator) corresponding to the asynchronous transfer mode from the data stream, transmission frames that correspond to the SDH or, ~~respectively,~~ PDH transmission system being, in turn, formed therefrom in a means 5 or PDH/SDH Transmission Frame Generator.

Independently ~~thereof~~ or as an ~~alternative~~ ~~thereto~~, transmission frames that correspond to the SDH or, ~~respectively,~~ PDH transmission system are inventively generated directly from the data stream ~~in a direct way~~ in a means 6 or Direct PDH/SDH Transmission Frame Generator, dependent on the application. The direct generation of a PDH frame 18 from the data stream is shown by way of example in Figure 2. The means 6 thereby inserts a start field STF 20 that contains an offset field 21, a sequence number 22 and a parity bit 23 at the beginning of the PDH transmission frame 18, (i.e., following the frame start 19). The offset field 21 contains data that identify the position of the first mini-cell 7a in the PDH frame 18. The start field 20 of the PDH frame 18 ~~thereby~~ essentially corresponds to the start field of the ATM data packets that is schematically shown in Figure 5. Stuffing data 24 are provided at the end of the PDH frame 18 in order to fill up the space that is not needed.

Figure 3 shows a block circuit diagram of an exemplary alternate embodiment of an apparatus for the reception of data in an SDH or, ~~respectively,~~ PDH transmission system according to the present invention. The reception means is likewise designed for alternative or parallel operation in a transmission system corresponding to the AAL2 specification, and its AAL2 reception branch comprises a means 25 at which transmission frames that correspond to the SDH or, ~~respectively,~~ PDH transmission system arrive. These data can be transmitted, for example, either via mobile

(i.e., ATM Data Packet Generator)

radiotelephone or via fixed lines. The means 25 generates data packets corresponding to the ATM or, ~~respectively, the~~ asynchronous transfer mode from the frames corresponding to the SDH or, ~~respectively,~~ PDH transmission system. A means 26 (i.e., Mini-Cell Data Stream Generator) generates a data stream composed of mini-cells from the ATM cells. A demultiplexer 28 distributes the mini-cells contained in the data stream onto the respective voice channels 30a, 30b ... 30n, and a means 29 (i.e., Voice Data Arrangement Unit) generates to corresponding voice signals from the information in the mini-cells. The means 25, 26, 28 and 29 thus meet the AAL2 specification.

(i.e., Direct Data Stream Generator)

Inventively, a means 27 is provided wherein the incoming transmission frames that correspond to the SDH or, ~~respectively,~~ PDH transmission system are directly converted into a data stream. Dependent on the requirements, ~~thus,~~ the means 27 works independently of, alternatively to or parallel to the means 25 and 26. Similar to the data stream regenerated in the means 26, the data stream directly generated in the means 27 is supplied to the demultiplexer 28.

The present invention further comprises a transmission system that contains an apparatus for sending data according to the exemplary embodiment shown in Figure 1 as well as a means for receiving data according to the exemplary embodiment shown in Figure 3. The SDH or, respectively, PDH transmission system, in accord wherewith the data are transmitted, can thereby be a mobile radiotelephone system, a system with fixed lines, etc.

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